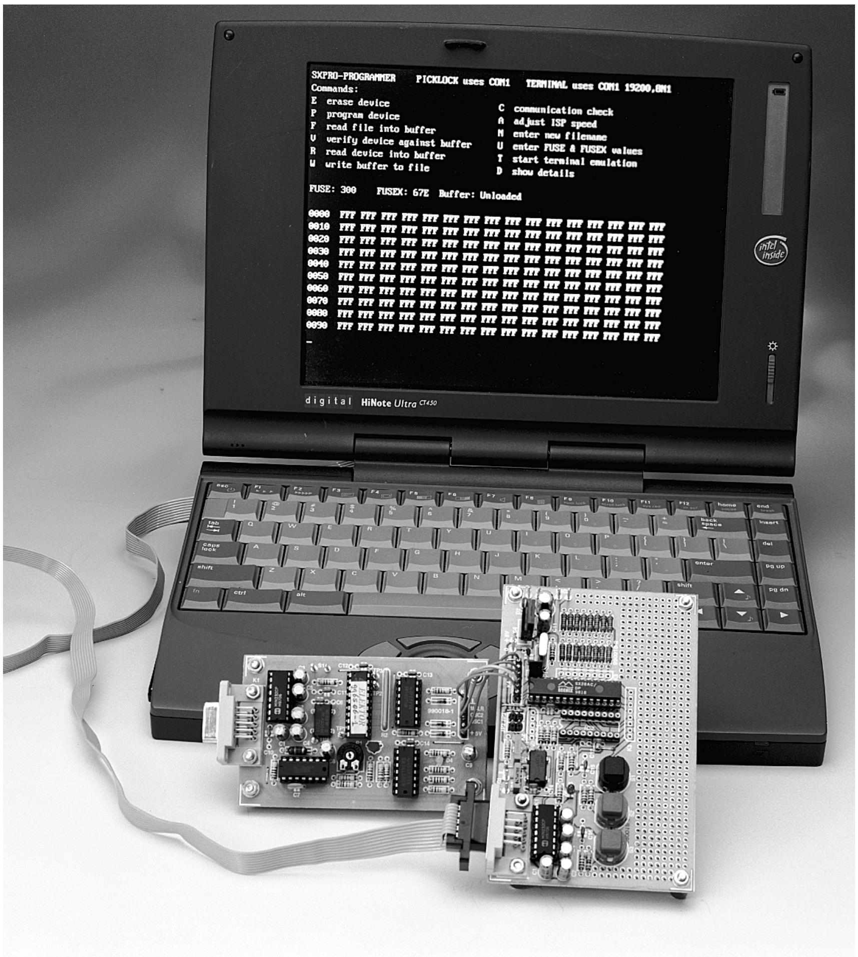
SX-microcontroller evaluation system (2)

part 2: the programming adaptor

In this second instalment of the series we present the PICKALOCK programming adaptor, which acts as the link between the programming software on the PC and the SX-microcontroller on the prototyping or application board. In this configuration, a high-speed Atmel controller acts as a protocol converter.



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SXPRO-PROGRAMMER   PICKLOCK uses COM1   TERMINAL uses COM1 19200,8N1
Commands:
E  erase device                        C  communication check
P  program device                      A  adjust ISP speed
F  read file into buffer               N  enter new filename
V  verify device against buffer        U  enter FUSE & FUSEX values
R  read device into buffer             T  start terminal emulation
W  write buffer to file                D  show details

FUSE: 300    FUSEX: 67E  Buffer: Unloaded

0000  FFF FFF FFF FFF FFF FFF FFF FFF FFF FFF FFF FFF FFF FFF FFF FFF
0010  FFF FFF FFF FFF FFF FFF FFF FFF FFF FFF FFF FFF FFF FFF FFF FFF
0020  FFF FFF FFF FFF FFF FFF FFF FFF FFF FFF FFF FFF FFF FFF FFF FFF
0030  FFF FFF FFF FFF FFF FFF FFF FFF FFF FFF FFF FFF FFF FFF FFF FFF
0040  FFF FFF FFF FFF FFF FFF FFF FFF FFF FFF FFF FFF FFF FFF FFF FFF
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0090  FFF FFF FFF FFF FFF FFF FFF FFF FFF FFF FFF FFF FFF FFF FFF FFF
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Design by M. Ohsmann

Last month we showed you that the timing of the SX chips is pretty rapid when serial programming is used, and that the timing protocols are fairly strict. After due consideration, the designer came to the conclusion that an 8051 micro clocked at 18 MHz should really be able to handle all communication with the SX chip. The result of the design work is the PICKALOCK programming adaptor, whose circuit diagram is shown in **Figure 1**. Microcontroller IC3 is the heart of the circuit. Instead of the 'generic' 8051, a more up to date version, the Atmel 89C2051 is used in the circuit. Regular *Elektor Electronics* readers should know this chip from quite a few earlier publications. The link with the PC is established by serial interface driver IC1. The serial protocol is 19200,8,N,1. A switching regulator around IC6 supplies the

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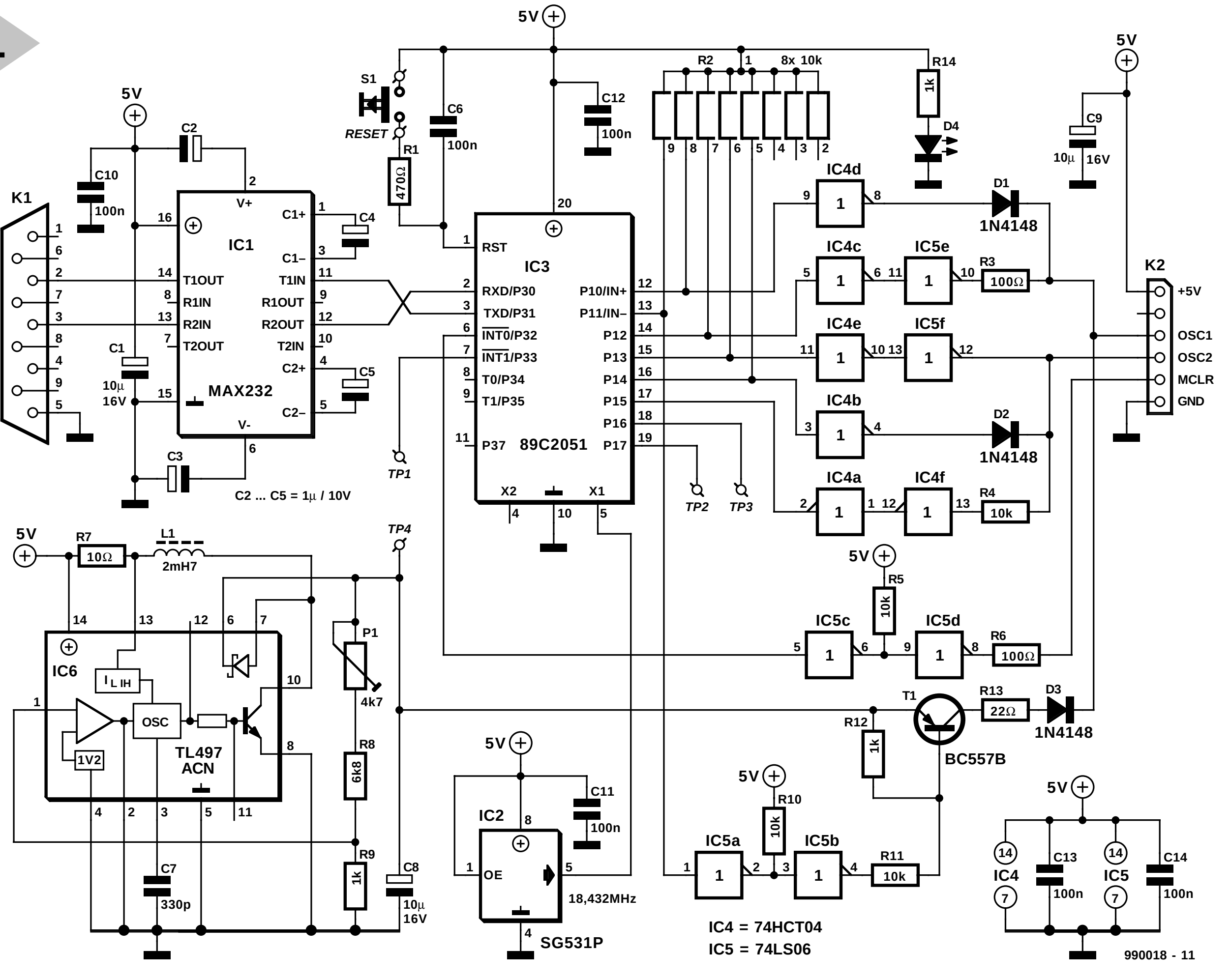

Figure 1. Circuit diagram of the PICKALOCK programming adaptor for SX microcontrollers.

12.5 V which is necessary to switch the SX processor to ‘programming’ mode. An integrated clock oscillator, IC2, is employed, operating at 18.432 MHz. Circuits IC4 and IC5 form the link between IC3 and the SX chip. The programming voltage may be connected to the OSC1 line by way of transistor T1. The same line may be switched to 5 V with the aid of IC4d and D1. The open-collector output of IC5e and resistor R3 enable the OSC1 line to be pulled to ground. A similar system is used on data line OSC2. Via IC4a and IC4f, processor IC3 is able to read the level on the line. The complete interface to the SX chip is configured in such a way that lines OSC1 and OSC2 are at high impedance during the reset state of IC3 (for example, after switching on). In this way, a quartz crystal oscillator circuit (as described in part 1) is allowed to oscillate on OSC1 and OSC2. The SX chip may also be reset by way of IC5c and IC5d. The +5-V supply voltage is borrowed from the SX-circuit to be programmed, via the 5-V pin on connector K2.

The photograph shows the SX evaluation board. The connections between the SX-PICKALOCK and the SX chip should be kept as short as possible, because stray capacitance and inductance (introduced by long wires) will degrade the oscillation behaviour of the SX quartz oscillator circuit in the frequency range 10 MHz and higher.

CONSTRUCTION AND FIRST USE

The copper track layout and component mounting plan of the single-sided printed circuit board developed for the programming adaptor are shown in **Figure 2**. As a matter of course, all ICs should be fitted in sockets. On pin-header K2, it is recommended to cut off the non-used pin between OSC1 and +5 V. By inserting the pin in the mating socket, the socket can not be fitted the wrong way around — a simple trick that can prevent a lot of problems.

While you build up the board, do not forget the wire links. Also note that K1 (RS232 interface) is a sub-D socket (i.e., a female connector). After a thorough visual inspection of the board, the circuit may be connected to 5 volts by way of the 5-V pin on K2. Next, check the operation of the switching regulator IC4, and if TP4 can be set to 12.7 V by adjusting preset P1. Then, having connected a PC running a terminal emulator program set to 19200,8,N,1 communication, the SX-PICKALOCK should produce a start-up message when IC3 is reset by pressing S1. Not much can go wrong, we’d say, provided you’ve done a proper soldering job.

FUNCTION OF THE SX-PICKALOCK

Actually, the programming adaptor only acts as a protocol converter. For that purpose, the PICKALOCK software stashed away in IC3 provides a number of functions. Although functionally essential, they are not terribly important to you, the user, mainly because the actual programming software runs on the PC, with the code in IC3 just acting as ‘glue’ between the PC software and the SX chip to be programmed. None the less, a description of the interface control software may be found on the diskette supplied for this project. It should be noted that some of the available commands can also be used to perform tests on the PICKALOCK hardware. These tests are remnants of the design work, and they are obviously not required once the hardware is fully functional. For example, routines are available that enable the ports of IC3 to be read and controlled as part of an integral hardware test procedure.

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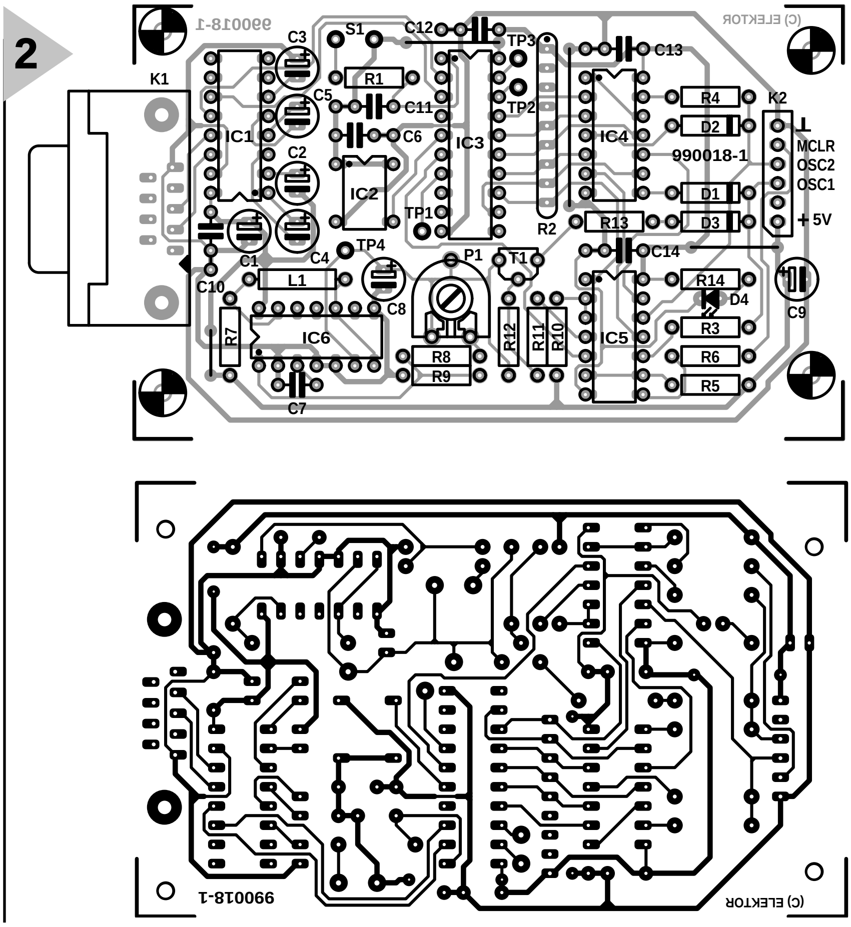

Figure 2. PCB artwork (board available ready-made).

COMPONENTS LIST

Resistors:
R1 = 470Ω
R2 = 10kΩ 8-way SIL array
R3,R6 = 100Ω
R4,R5,R10,R11 = 10kΩ
R7 = 10Ω
R8 = 6kΩ8
R9,R12,R14 = 1kΩ
R13 = 22Ω
P1 = 4kΩ7

Capacitors:
C1,C8,C9 = 10μF 16V radial
C2-C5 = 1μF 16V
C6,C10-C14 = 100nF ceramic
C7 = 330pF ceramic

Inductor:
L1 = 2mH7 (74mA)

Semiconductors:
D1,D2,D3 = 1N4148
D4 = LED (high-efficiency)
T1 = BC557B
IC1 = MAX232 (Maxim)
IC2 = SG531P, 18.4320MHz (Epson)
IC3 = 89C2051, programmed, order code 996506-1
IC4 = 74HCT04
IC5 = 74LS06
IC6 = TL497ACN

Miscellaneous:
K1 = 9-way sub-D socket (female), angled, PCB mount
S1 = push-button (make contact)
K2 = 6-way pinheader (see text)
Case: e.g. Bopla E430
Diskette, order code 996007-1
PCB, order code 990018-1

USING THE SX-PICKALOCK

Scenix SX microcontrollers may be programmed by launching the PICALOCK control program, SXPRO.EXE, on the PC. These microcontrollers may also be read, erased and reprogrammed. The FUSE and DEVICE words may be set up as required if that has not been done already in assembler code.

The simple user interface offered by the SXPRO program is shown in **Figure 3**. Files generated by our SX assembler are processed directly. Although this may appear a ready to go situation, you should not forget that you first have to build a test board with the new processor.

SX DEMO BOARDS AND PROGRAMS

An SX experiment/prototyping board will be discussed in next month's instalment (part 3 of the series). Originally, there were two separate boards, one for the SX18 version and one for the SX28. The final product, however, is a single board that can be used by both processor versions. This board is already shown on a couple of photographs.

Apart from the construction of the prototyping board, next month's instalment will also deal with programming the SX controllers.

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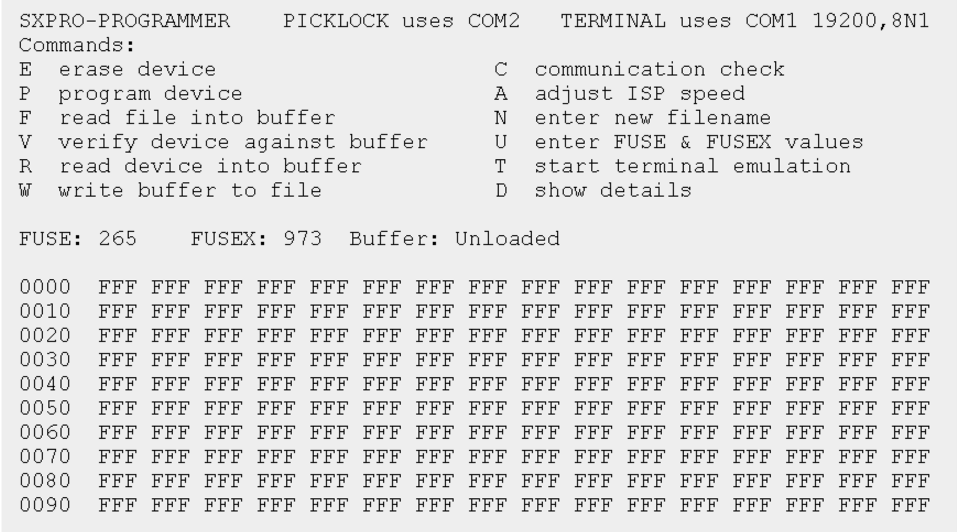
Figure 3. SXPRO user interface.



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V  verify device against buffer           U  enter FUSE & FUSEX values
R  read device into buffer                T  start terminal emulation
W  write buffer to file                   D  show details

FUSE: 265    FUSEX: 973   Buffer: Unloaded

0000  FFF FFF FFF FFF FFF FFF FFF FFF FFF FFF FFF FFF FFF FFF FFF FFF
0010  FFF FFF FFF FFF FFF FFF FFF FFF FFF FFF FFF FFF FFF FFF FFF FFF
0020  FFF FFF FFF FFF FFF FFF FFF FFF FFF FFF FFF FFF FFF FFF FFF FFF
0030  FFF FFF FFF FFF FFF FFF FFF FFF FFF FFF FFF FFF FFF FFF FFF FFF
0040  FFF FFF FFF FFF FFF FFF FFF FFF FFF FFF FFF FFF FFF FFF FFF FFF
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